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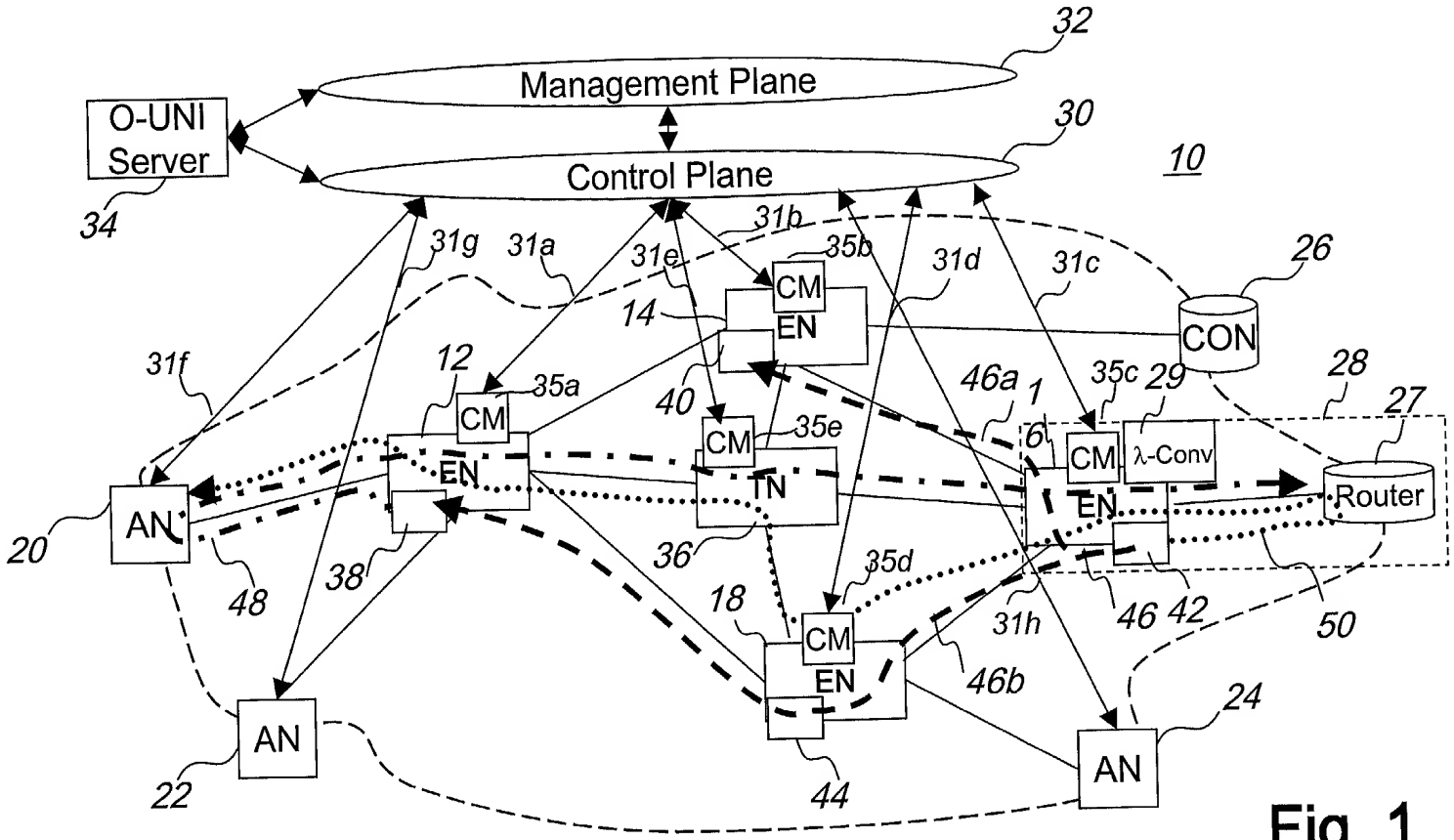

Fig. 1

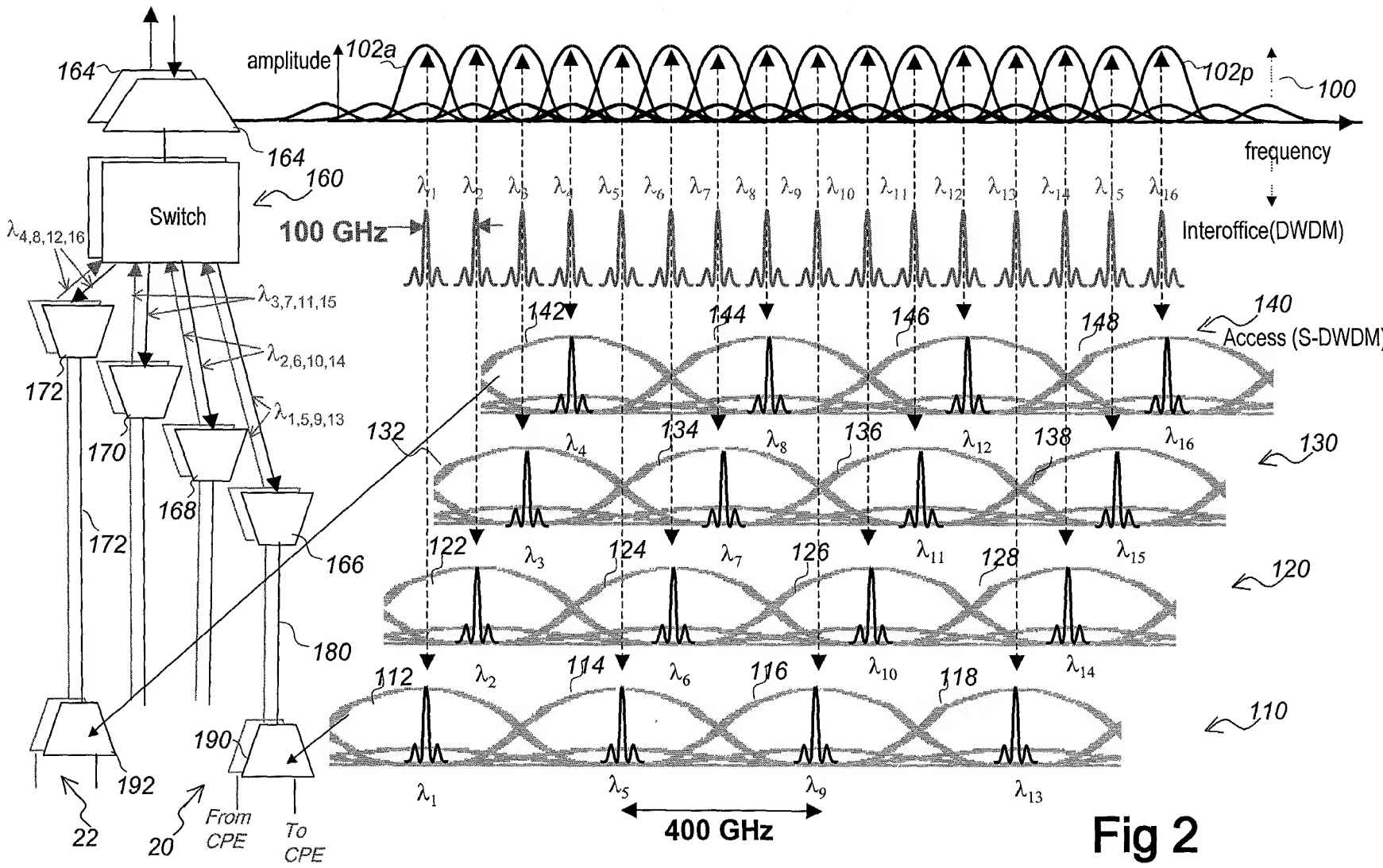
164
amplitude
102a
102p
100
frequency
164
160
Switch
100 GHz
Interoffice(DWDM)
$\lambda_{4,8,12,16}$
$\lambda_{3,7,11,15}$
$\lambda_{2,6,10,14}$
$\lambda_{1,5,9,13}$
140
Access (S-DWDM)
142
144
146
148
172
170
168
172
132
134
136
138
130
166
122
124
126
128
120
180
112
114
116
118
110
190
192
22
20
From CPE
To CPE
400 GHz

Fig 2

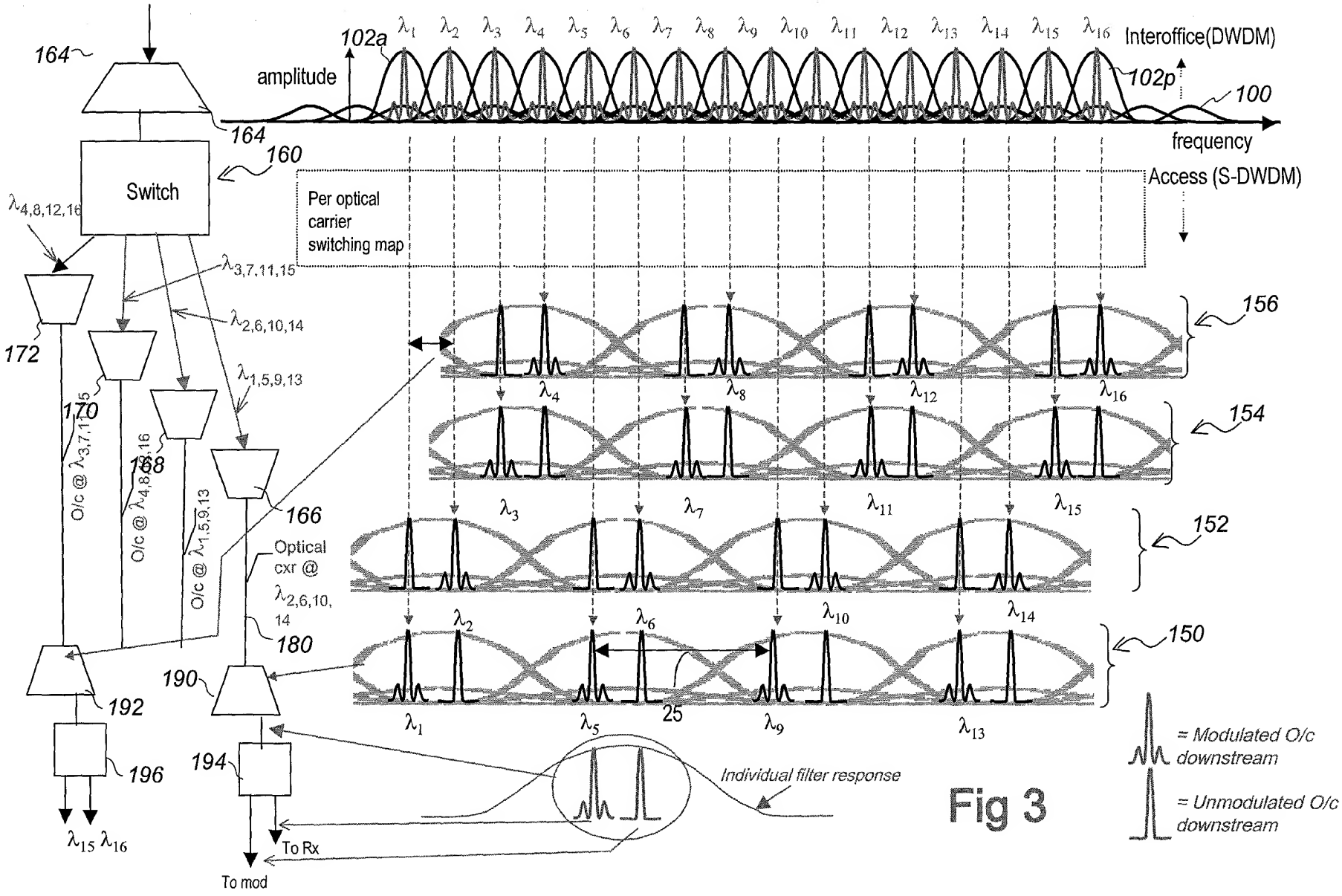
164
164
160
Switch
$\lambda_{4,8,12,16}$
$\lambda_{3,7,11,15}$
$\lambda_{2,6,10,14}$
$\lambda_{1,5,9,13}$
172
170
168
166
O/c @ $\lambda_{3,7,11,15}$
O/c @ $\lambda_{4,8,12,16}$
O/c @ $\lambda_{1,5,9,13}$
Optical cxr @ $\lambda_{2,6,10,14}$
180
190
192
194
196
λ_{15} λ_{16}
To Rx
To mod
102a
amplitude
λ_1 λ_2 λ_3 λ_4 λ_5 λ_6 λ_7 λ_8 λ_9 λ_{10} λ_{11} λ_{12} λ_{13} λ_{14} λ_{15} λ_{16}
Interoffice(DWDM)
102p
100
frequency
Access (S-DWDM)
Per optical carrier switching map
156
154
152
150
λ_4 λ_8 λ_{12} λ_{16}
λ_3 λ_7 λ_{11} λ_{15}
λ_2 λ_6 λ_{10} λ_{14}
λ_1 λ_5 λ_9 λ_{13}
25
Individual filter response
= Modulated O/c downstream
= Unmodulated O/c downstream

Fig 3

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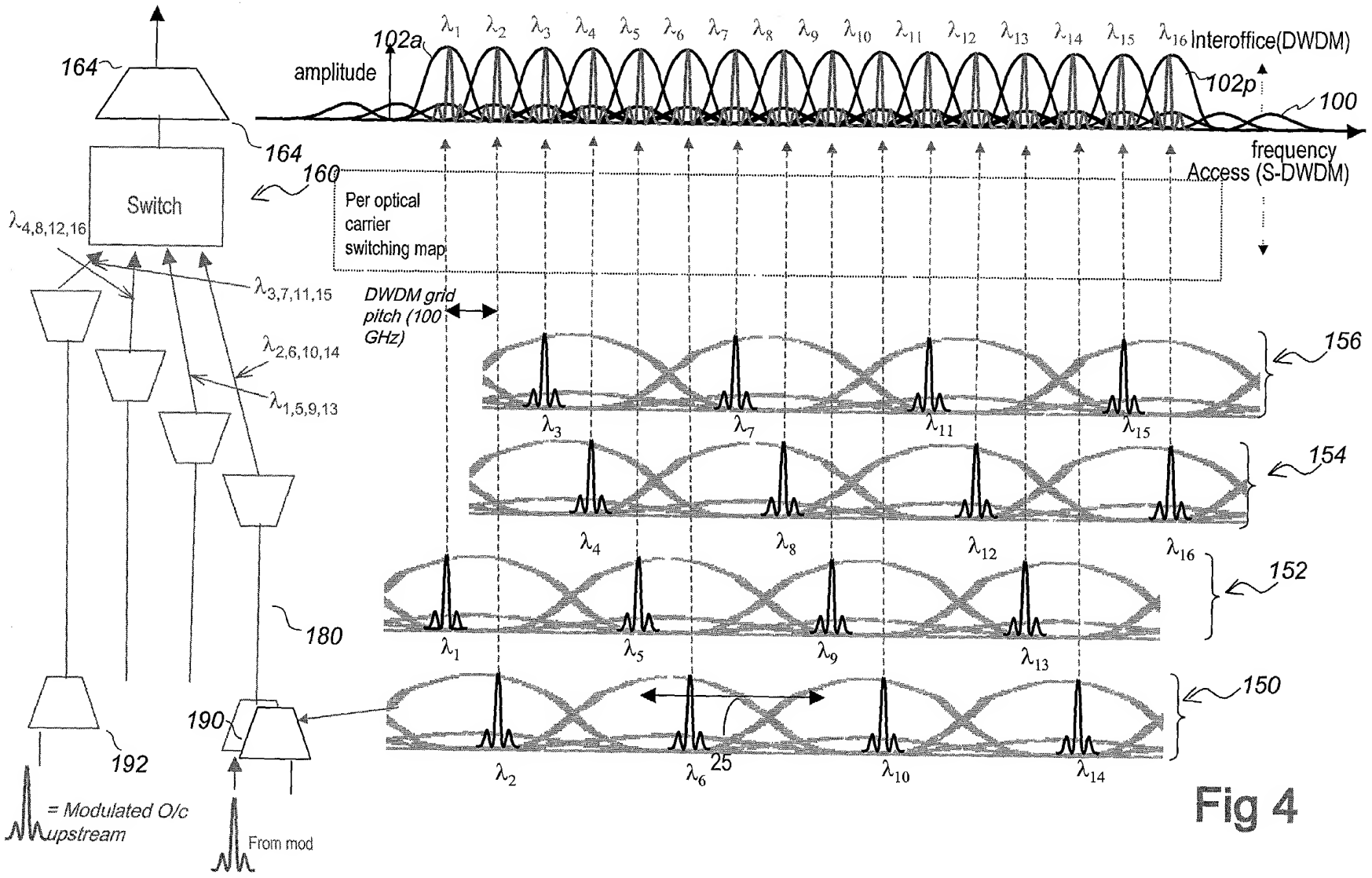

Fig 4

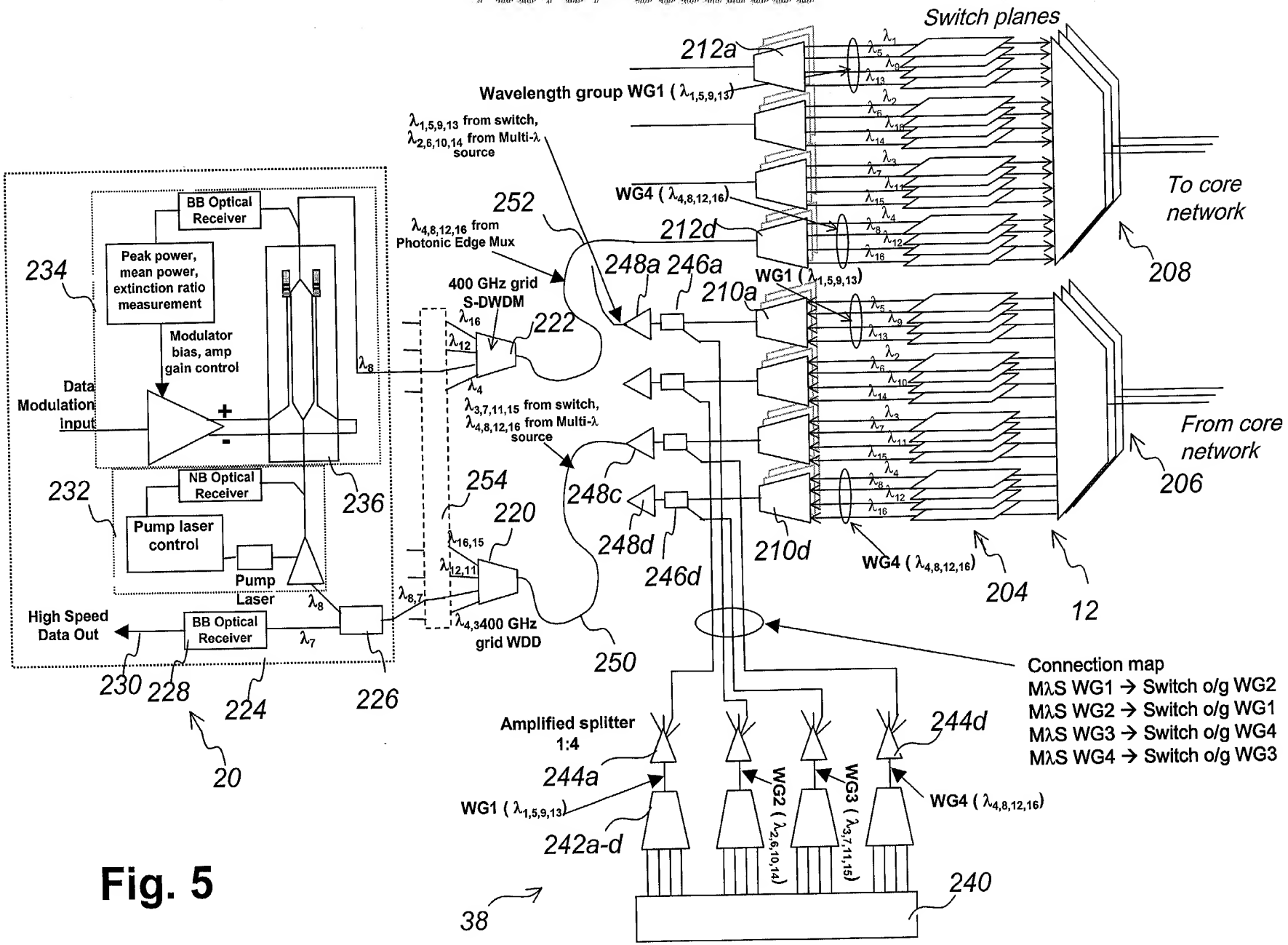
Switch planes
212a
Wavelength group WG1 ($\lambda_{1,5,9,13}$)
$\lambda_{1,5,9,13}$ from switch,
$\lambda_{2,6,10,14}$ from Multi-λ source
252
WG4 ($\lambda_{4,8,12,16}$)
212d
$\lambda_{4,8,12,16}$ from Photonic Edge Mux
248a 246a
210a
WG1 ($\lambda_{1,5,9,13}$)
To core network
208
400 GHz grid S-DWDM
222
$\lambda_{3,7,11,15}$ from switch,
$\lambda_{4,8,12,16}$ from Multi-λ source
254
248c
220
248d
246d
210d
WG4 ($\lambda_{4,8,12,16}$)
From core network
206
204
12
250
Connection map
MλS WG1 → Switch o/g WG2
MλS WG2 → Switch o/g WG1
MλS WG3 → Switch o/g WG4
MλS WG4 → Switch o/g WG3
Amplified splitter 1:4
244a
244d
WG1 ($\lambda_{1,5,9,13}$)
WG2 ($\lambda_{2,6,10,14}$)
WG3 ($\lambda_{3,7,11,15}$)
WG4 ($\lambda_{4,8,12,16}$)
242a-d
240
38
BB Optical Receiver
Peak power, mean power, extinction ratio measurement
234
Modulator bias, amp gain control
Data Modulation input
236
NB Optical Receiver
232
Pump laser control
Pump Laser
High Speed Data Out
BB Optical Receiver
230
228
224
226
20

Fig. 5

Patent Application

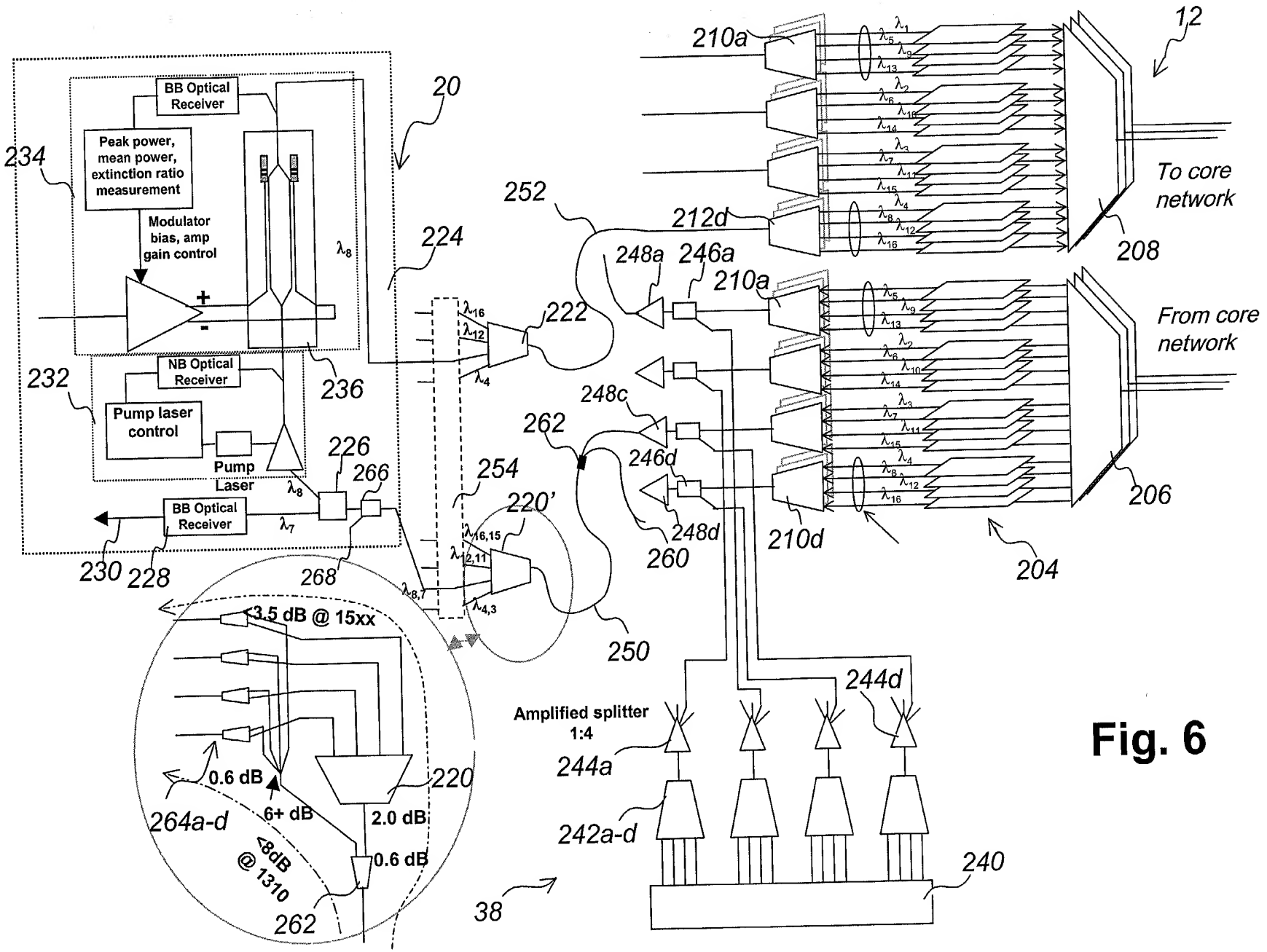

Fig. 6

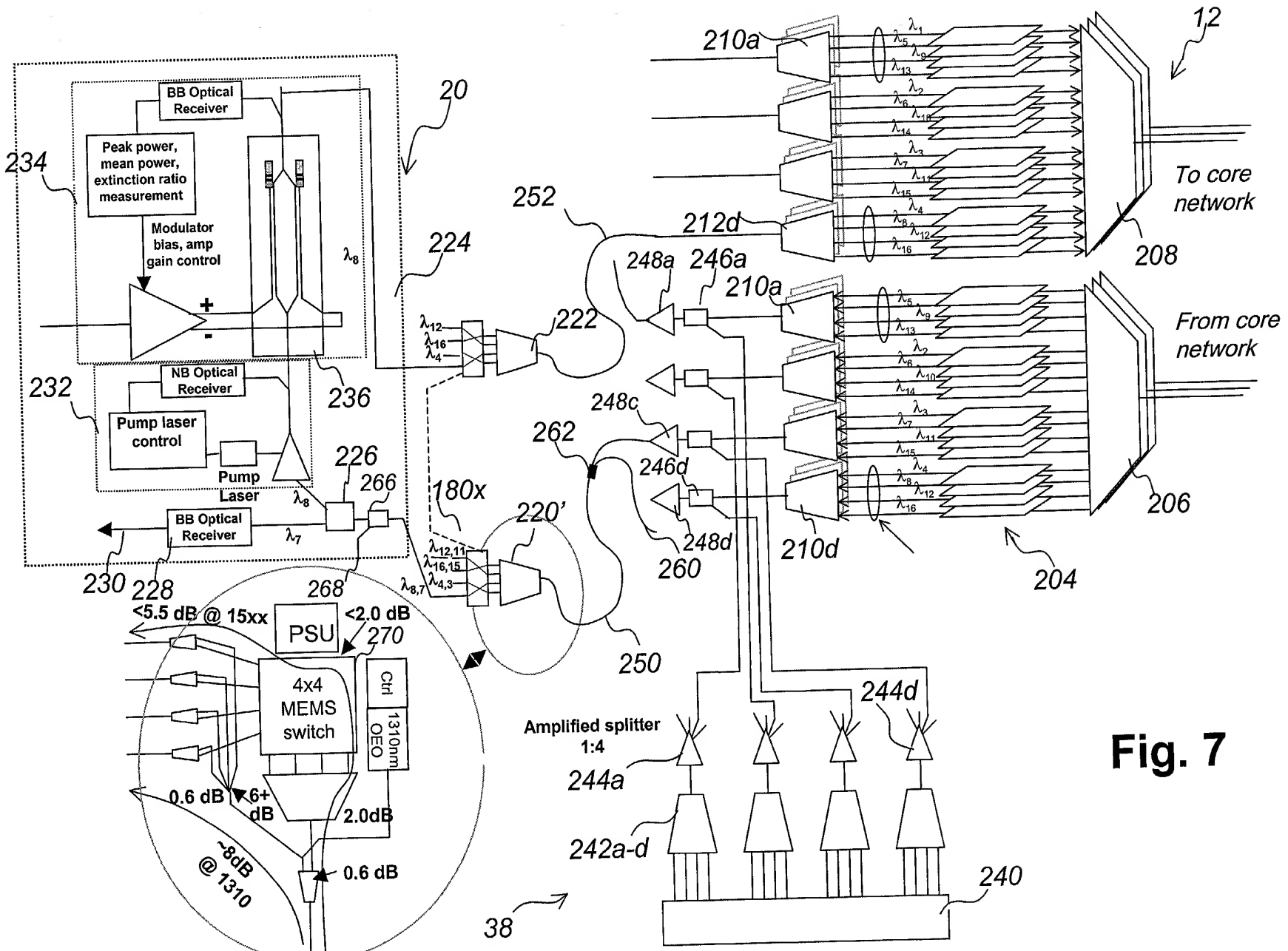
BB Optical Receiver
Peak power, mean power, extinction ratio measurement
Modulator bias, amp gain control
NB Optical Receiver
Pump laser control
Pump Laser
BB Optical Receiver
PSU
4x4 MEMS switch
Ctrl
1310nm OEO
<5.5 dB @ 15xx
<2.0 dB
0.6 dB
6+ dB
2.0dB
0.6 dB
~8dB @ 1310
Amplified splitter 1:4
To core network
From core network
20
234
232
236
224
222
226
266
268
270
180x
220'
250
252
262
260
210a
212d
248a
246a
248c
246d
248d
210d
208
206
204
244a
244d
242a-d
240
38
230
228

Fig. 7

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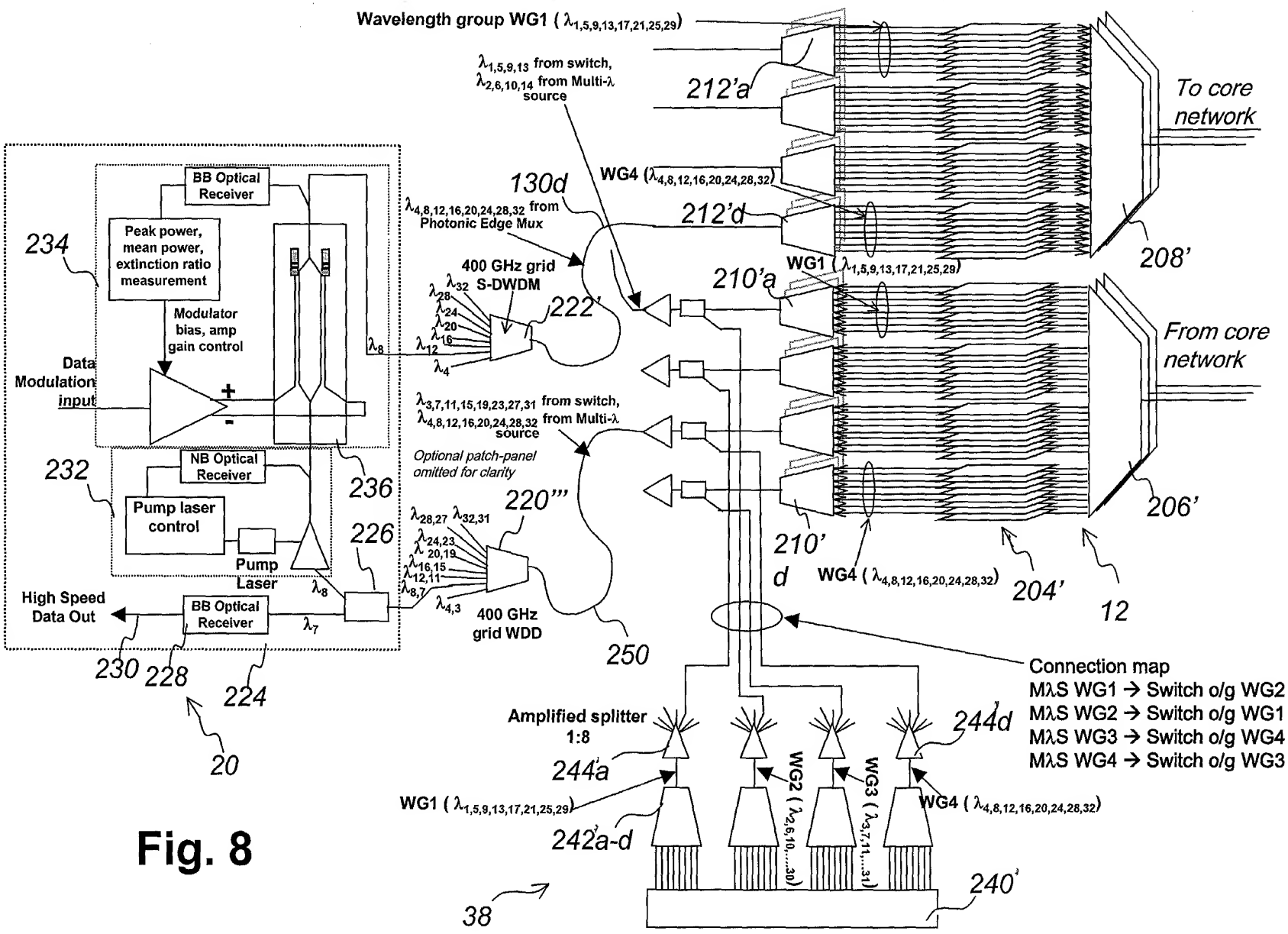

Fig. 8

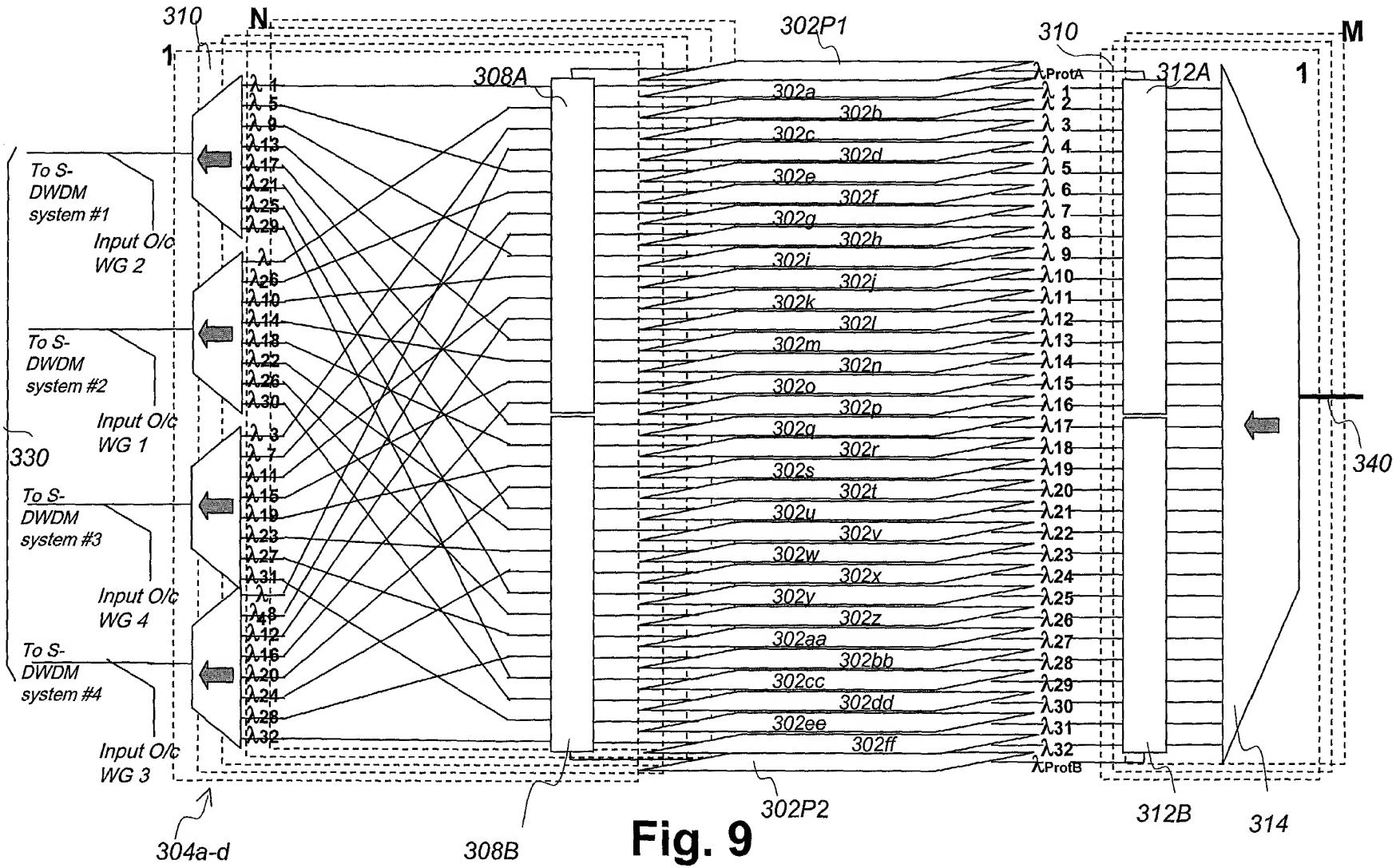
310
N
1
302P1
310
M
1
308A
312A
λProtA
λ 1
λ 2
λ 3
λ 4
λ 5
λ 6
λ 7
λ 8
λ 9
λ10
λ11
λ12
λ13
λ14
λ15
λ16
λ17
λ18
λ19
λ20
λ21
λ22
λ23
λ24
λ25
λ26
λ27
λ28
λ29
λ30
λ31
λ32
λProtB
302a
302b
302c
302d
302e
302f
302g
302h
302i
302j
302k
302l
302m
302n
302o
302p
302q
302r
302s
302t
302u
302v
302w
302x
302y
302z
302aa
302bb
302cc
302dd
302ee
302ff
To S-DWDM system #1
Input O/c WG 2
To S-DWDM system #2
Input O/c WG 1
330
To S-DWDM system #3
Input O/c WG 4
To S-DWDM system #4
Input O/c WG 3
340
304a-d
308B
302P2
312B
314

Fig. 9

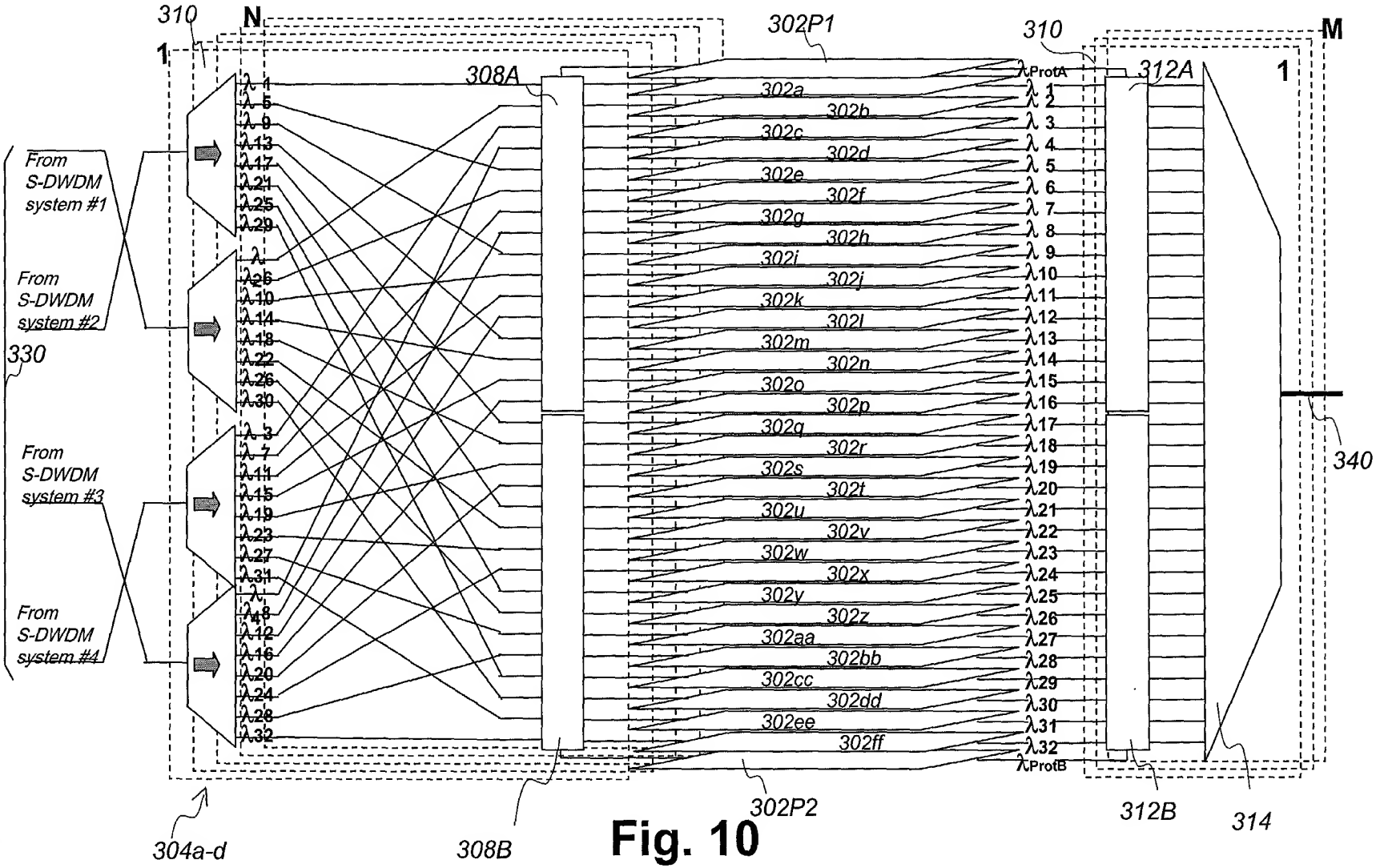
310
N
1
308A
302P1
310
M
1
312A
λProtA
λ 1
λ 2
λ 3
λ 4
λ 5
λ 6
λ 7
λ 8
λ 9
λ10
λ11
λ12
λ13
λ14
λ15
λ16
λ17
λ18
λ19
λ20
λ21
λ22
λ23
λ24
λ25
λ26
λ27
λ28
λ29
λ30
λ31
λ32
λProtB
302a
302b
302c
302d
302e
302f
302g
302h
302i
302j
302k
302l
302m
302n
302o
302p
302q
302r
302s
302t
302u
302v
302w
302x
302y
302z
302aa
302bb
302cc
302dd
302ee
302ff
From S-DWDM system #1
From S-DWDM system #2
From S-DWDM system #3
From S-DWDM system #4
330
340
304a-d
308B
302P2
312B
314

Fig. 10

TOSTOF 6862660

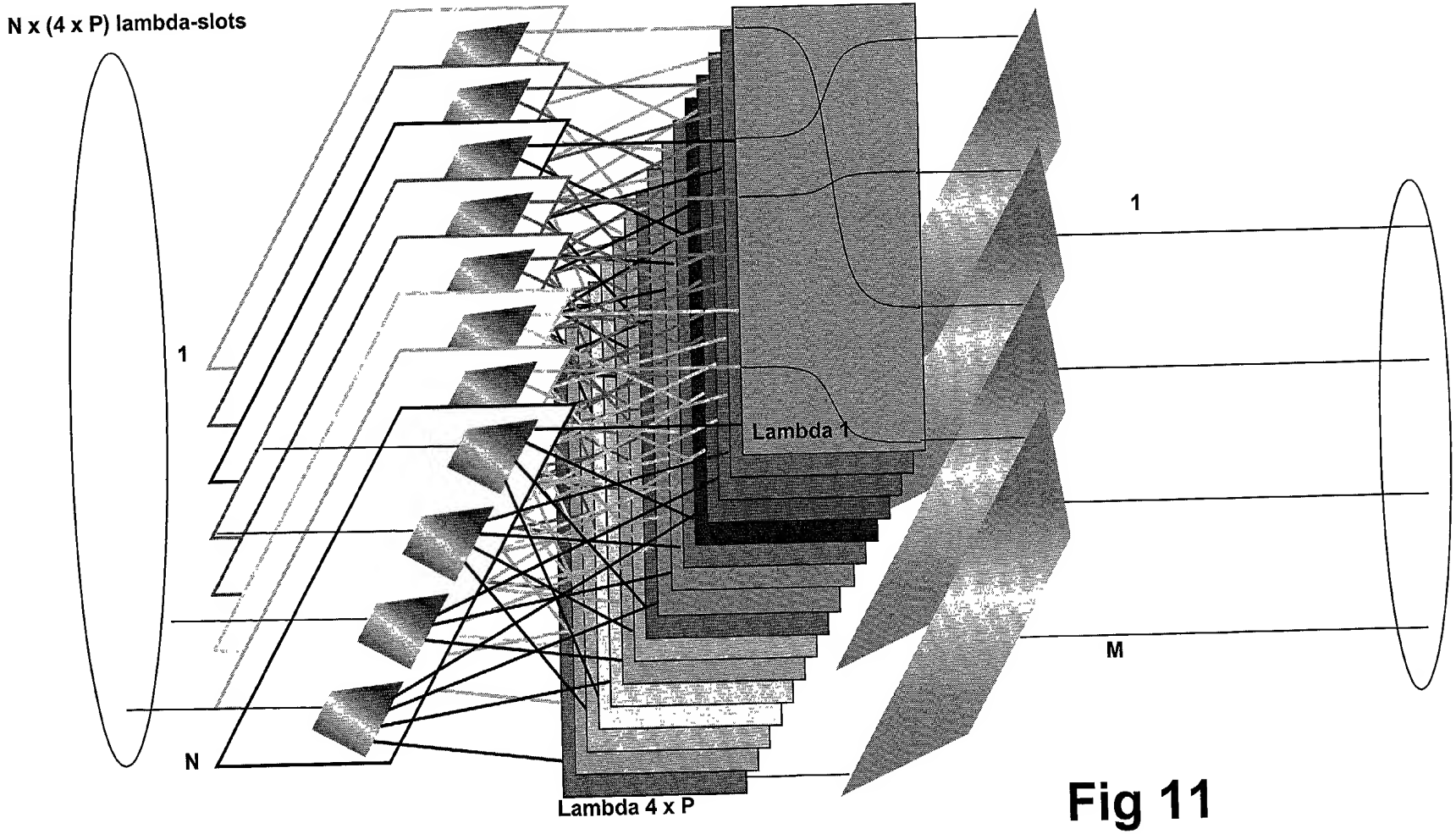

Fig 11

P= # of optical carrier frequencies/wavelengths for upstream transmission in EACH S-DWDM group.

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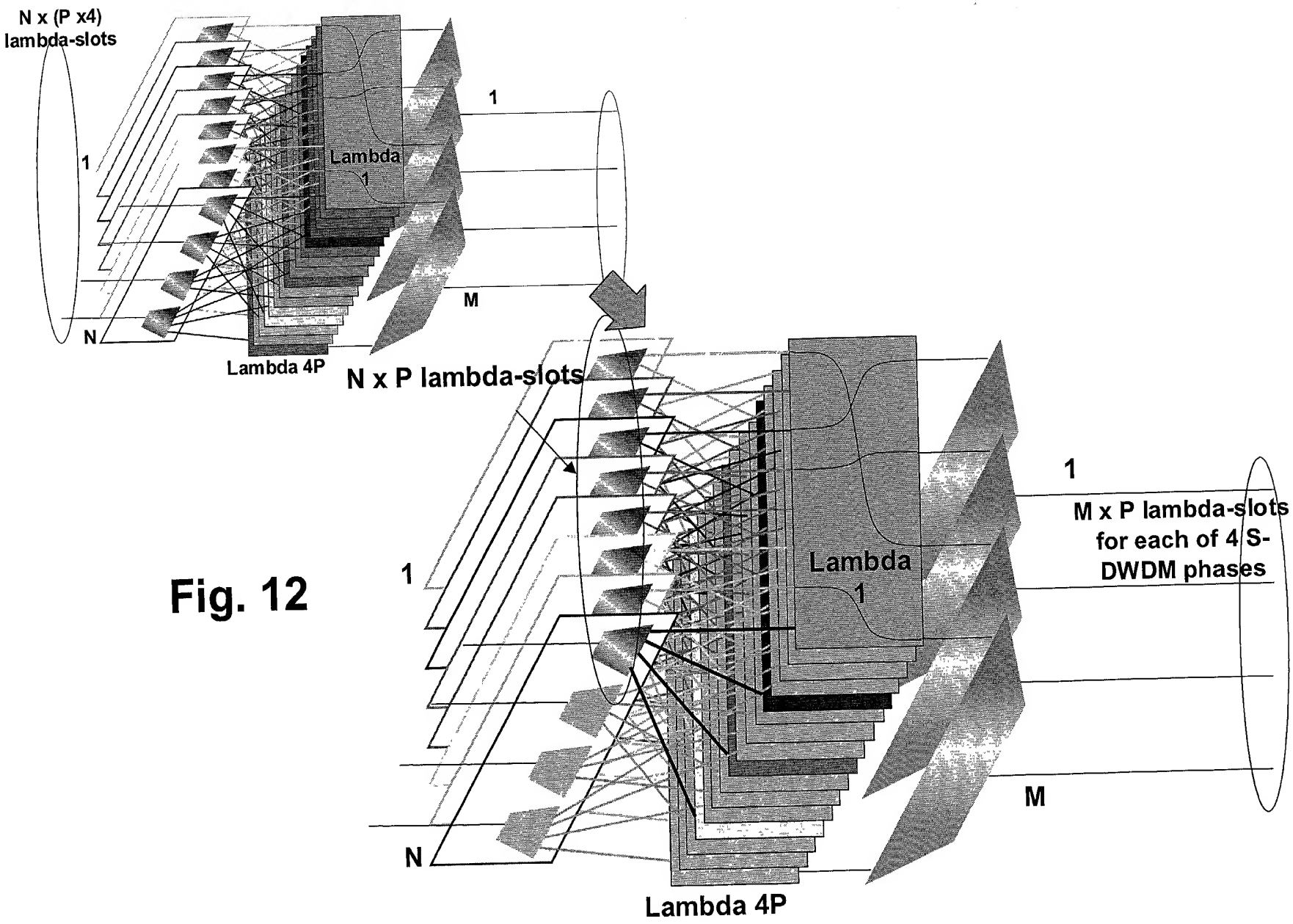

Fig. 12

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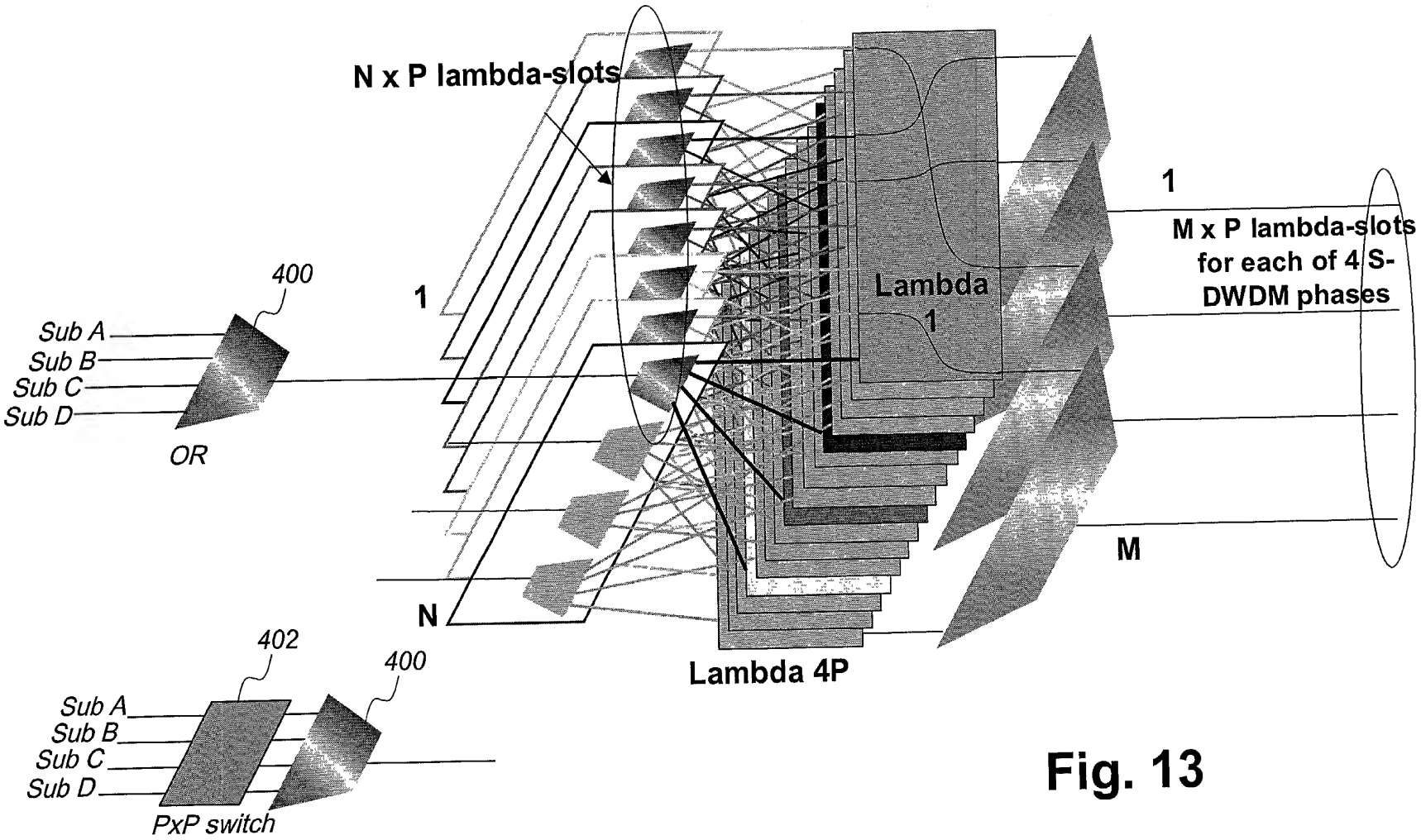

Fig. 13

Fig. 14

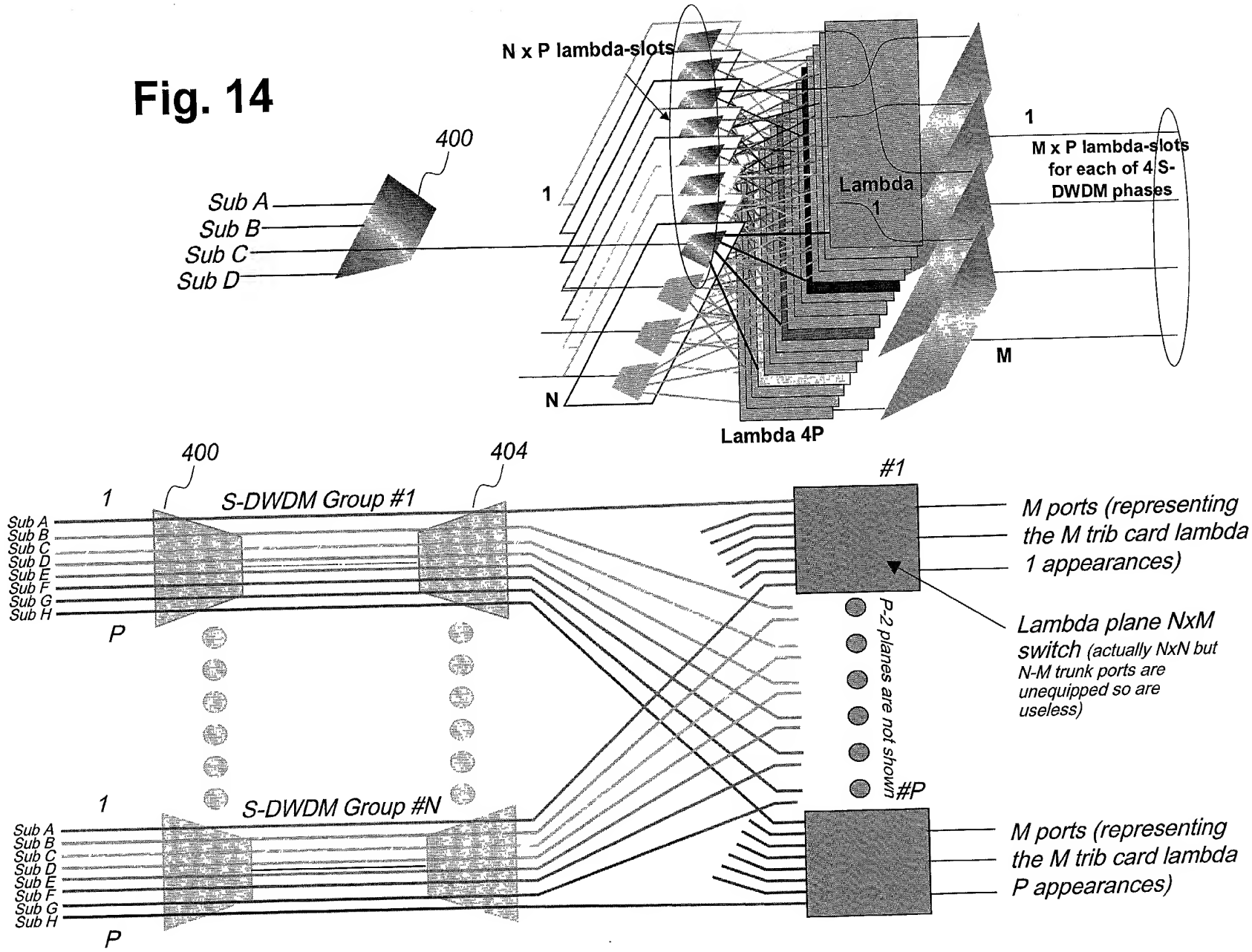
N x P lambda-slots
400
Sub A
Sub B
Sub C
Sub D
1
N
Lambda 1
Lambda 4P
1
M x P lambda-slots for each of 4 S-DWDM phases
M
404
S-DWDM Group #1
S-DWDM Group #N
Sub E
Sub F
Sub G
Sub H
P
#1
#P
M ports (representing the M trib card lambda 1 appearances)
Lambda plane NxM switch (actually NxN but N-M trunk ports are unequipped so are useless)
P-2 planes are not shown
M ports (representing the M trib card lambda P appearances)

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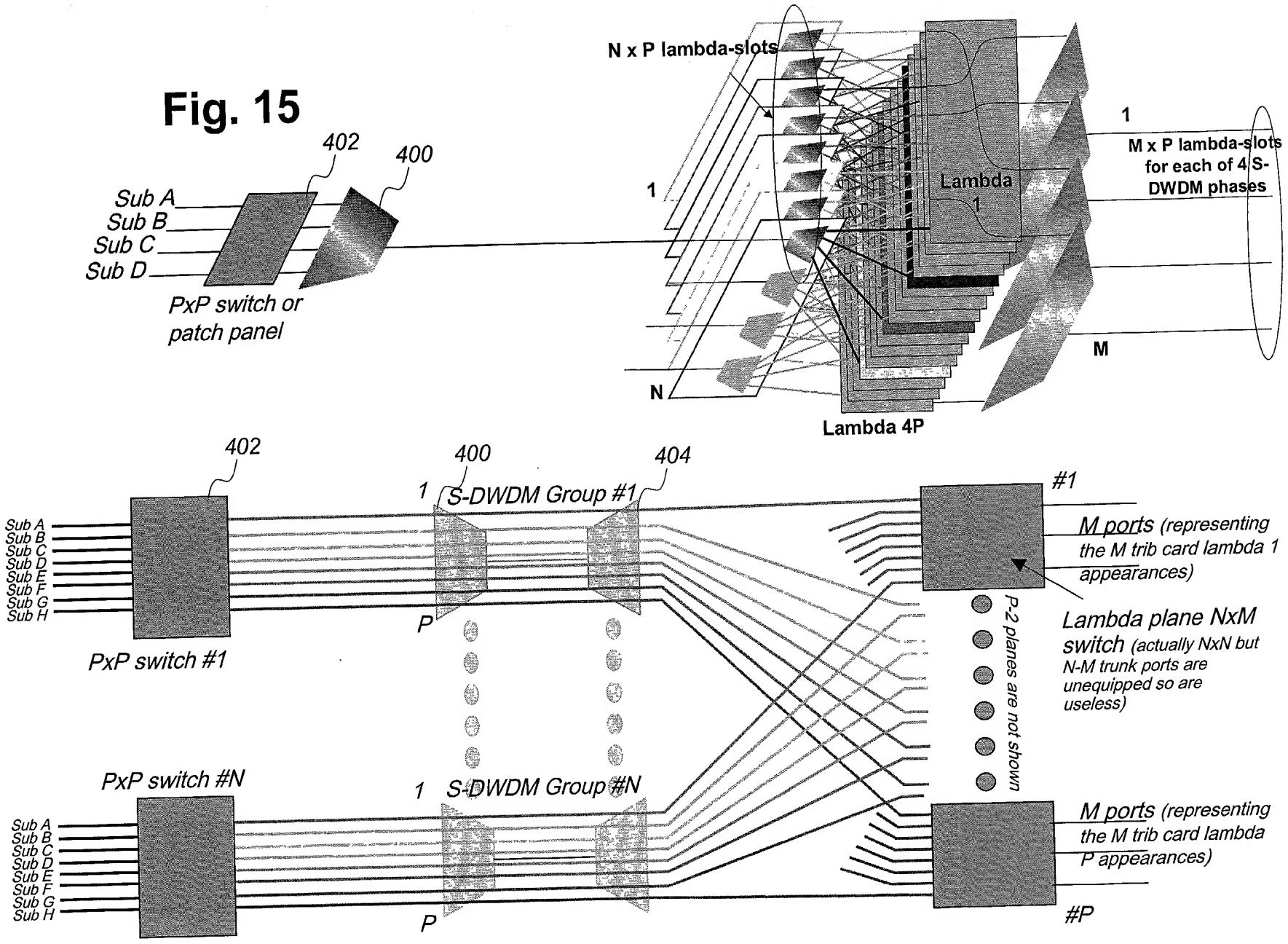
Fig. 15



EP 0 767 602 A2

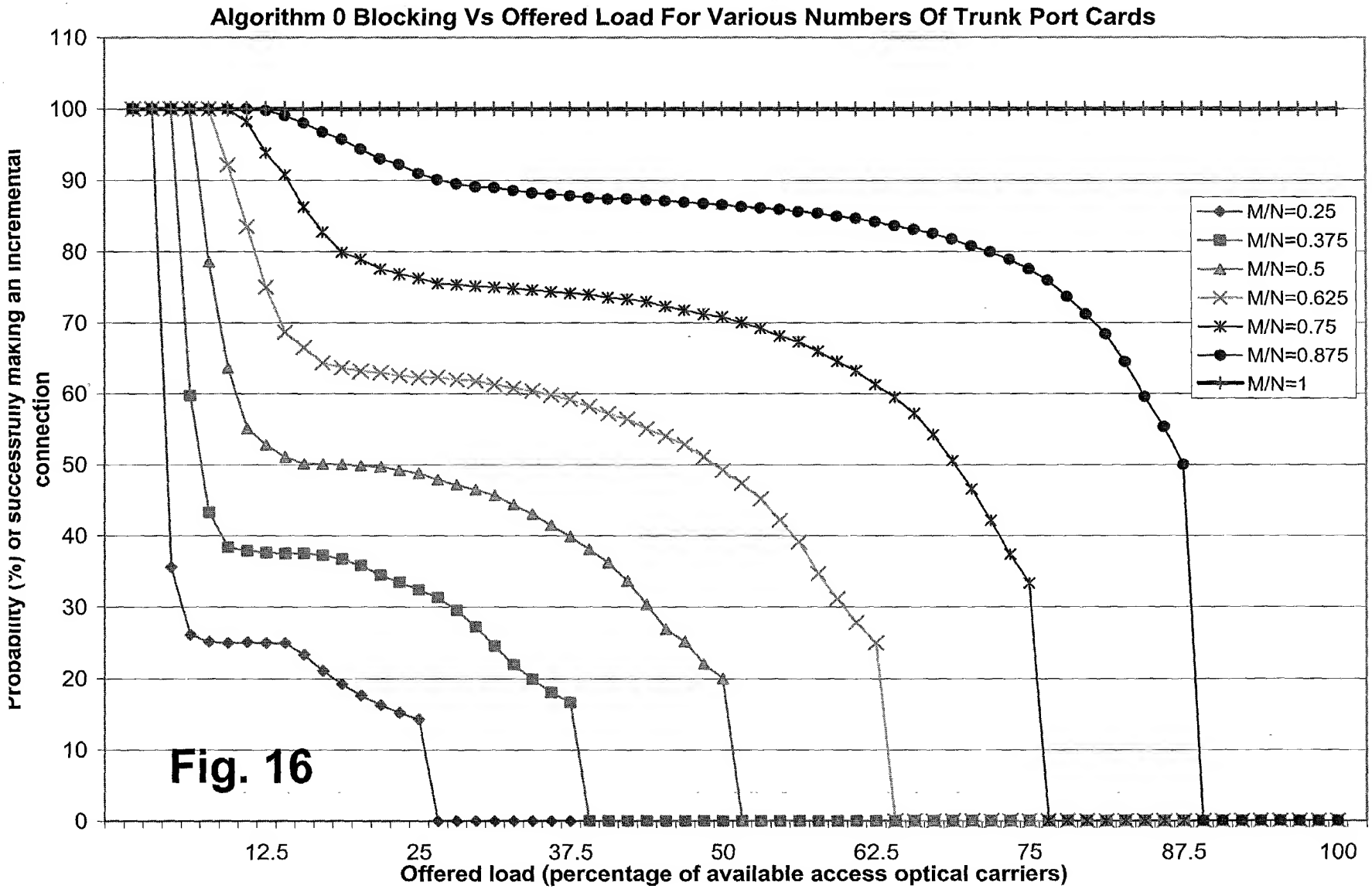


Fig. 16

Patent 6662660

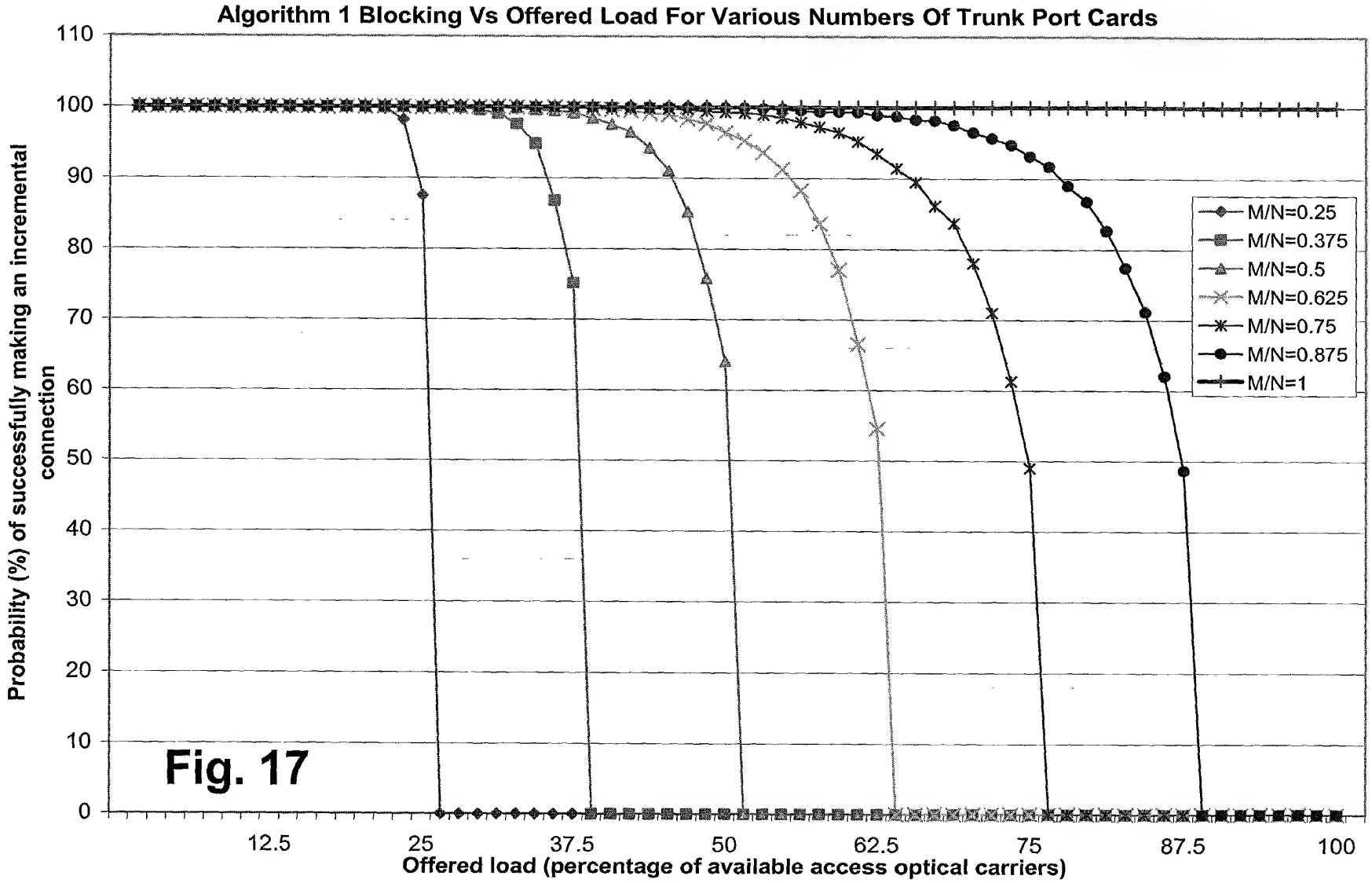


Fig. 17

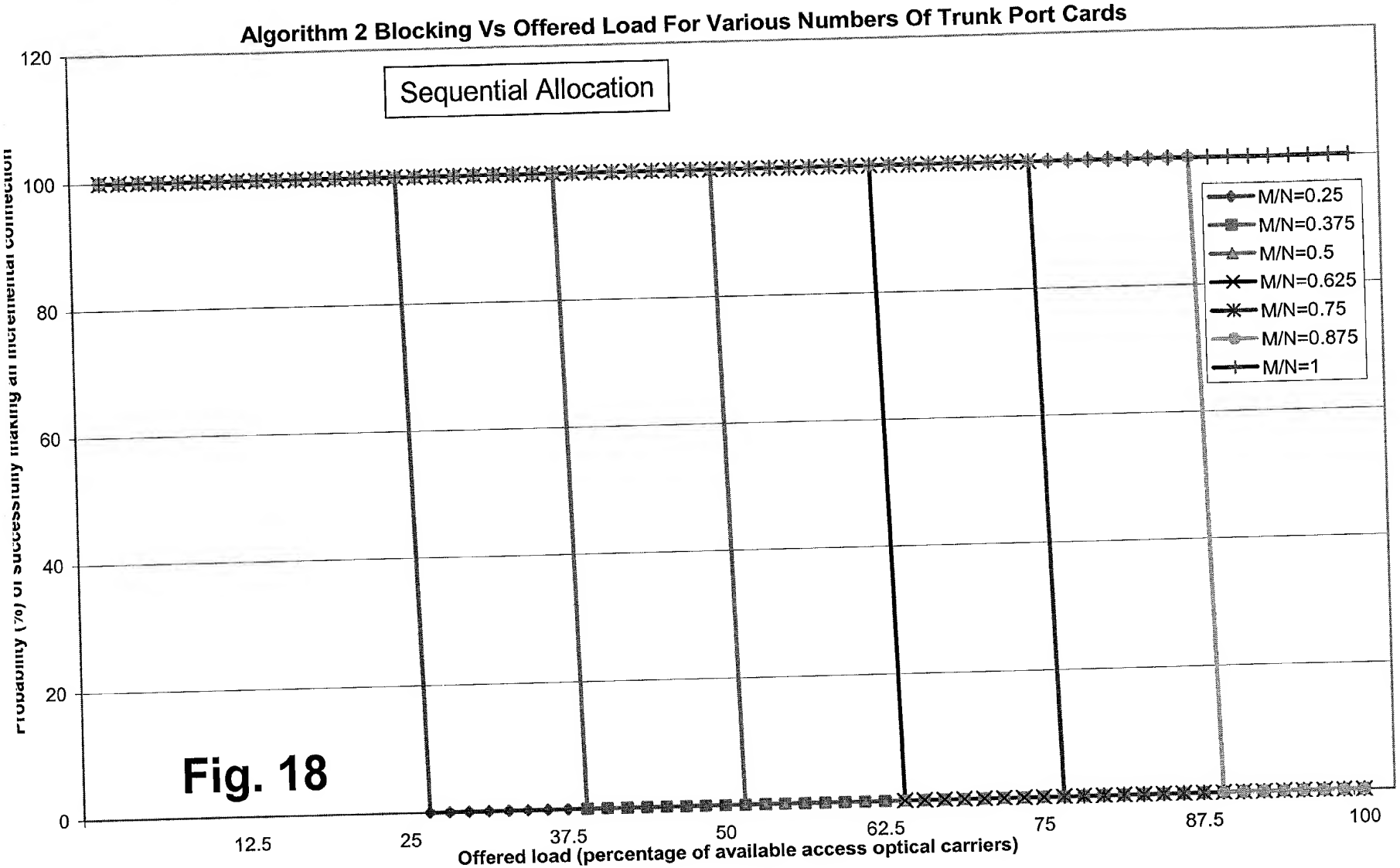
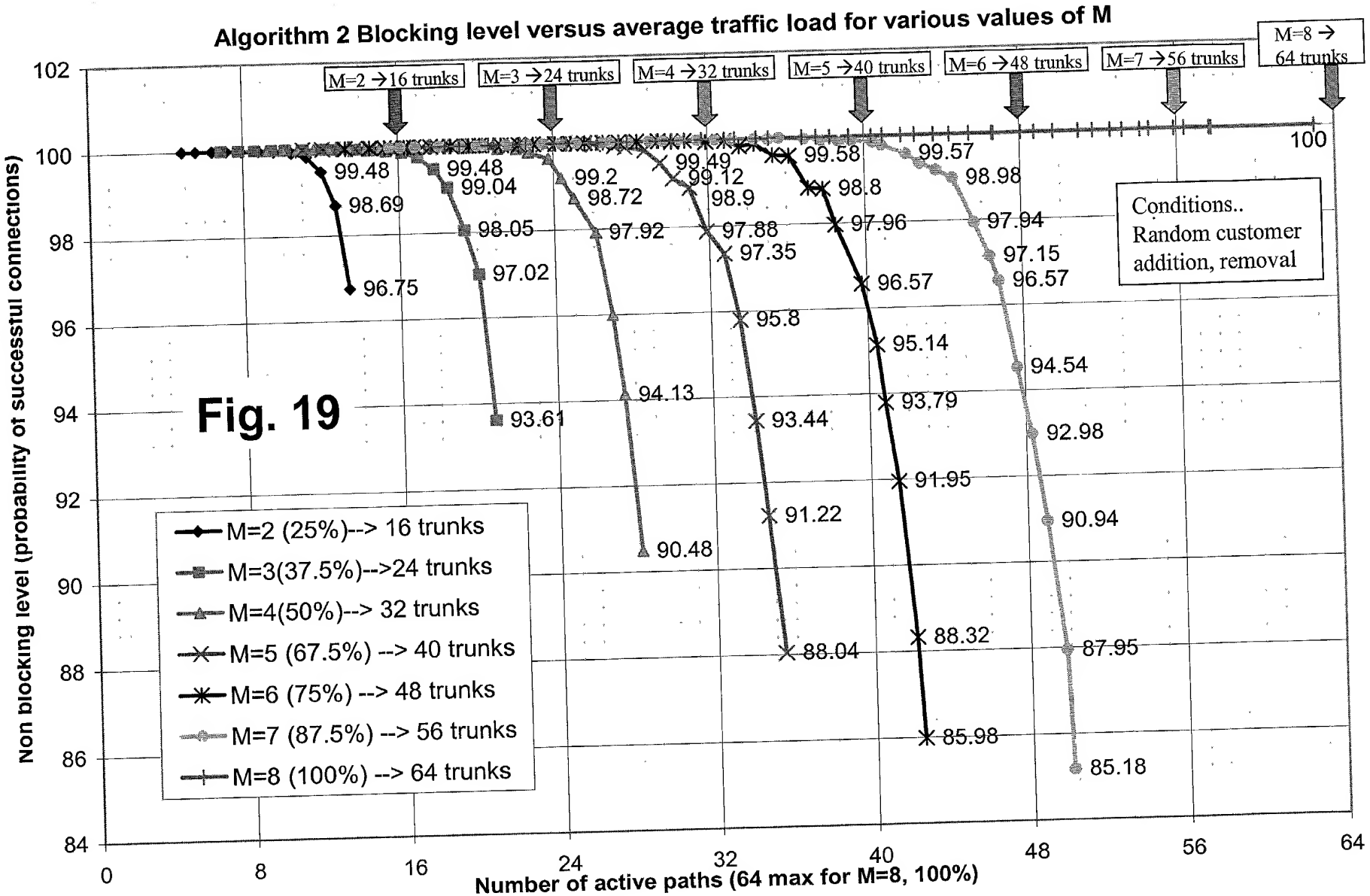

Algorithm 2 Blocking Vs Offered Load For Various Numbers Of Trunk Port Cards
Sequential Allocation
Probability (%) of successfully making an incremental connection
120
100
80
60
40
20
0
12.5
25
37.5
50
62.5
75
87.5
100
Offered load (percentage of available access optical carriers)
M/N=0.25
M/N=0.375
M/N=0.5
M/N=0.625
M/N=0.75
M/N=0.875
M/N=1

Fig. 18


Algorithm 2 Blocking level versus average traffic load for various values of M
M=2 →16 trunks
M=3 →24 trunks
M=4 →32 trunks
M=5 →40 trunks
M=6 →48 trunks
M=7 →56 trunks
M=8 → 64 trunks
Conditions..
Random customer addition, removal
Fig. 19
M=2 (25%)--> 16 trunks
M=3(37.5%)-->24 trunks
M=4(50%)--> 32 trunks
M=5 (67.5%) --> 40 trunks
M=6 (75%) --> 48 trunks
M=7 (87.5%) --> 56 trunks
M=8 (100%) --> 64 trunks
Non blocking level (probability of successful connections)
Number of active paths (64 max for M=8, 100%)
102
100
98
96
94
92
90
88
86
84
0
8
16
24
32
40
48
56
64
99.48
98.69
96.75
99.48
99.04
98.05
97.02
99.2
98.72
97.92
94.13
90.48
99.49
99.12
98.9
97.88
97.35
95.8
93.44
91.22
88.04
99.58
98.8
97.96
96.57
95.14
93.79
91.95
88.32
85.98
99.57
98.98
97.94
97.15
96.57
94.54
92.98
90.94
87.95
85.18
100
93.61

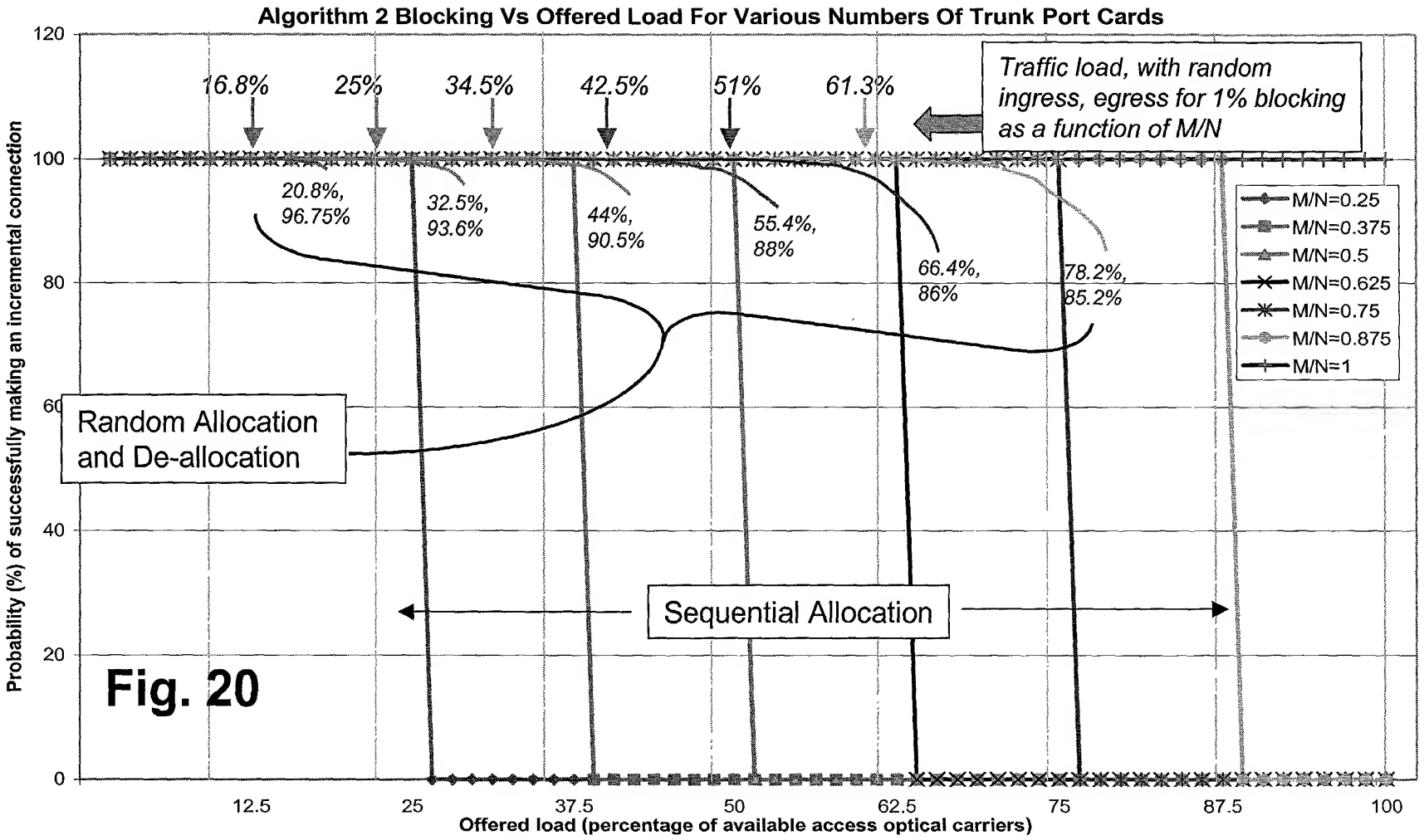

Algorithm 2 Blocking Vs Offered Load For Various Numbers Of Trunk Port Cards
Probability (%) of successfully making an incremental connection
Offered load (percentage of available access optical carriers)
120
100
80
60
40
20
0
12.5
25
37.5
50
62.5
75
87.5
100
16.8%
25%
34.5%
42.5%
51%
61.3%
Traffic load, with random ingress, egress for 1% blocking as a function of M/N
20.8%, 96.75%
32.5%, 93.6%
44%, 90.5%
55.4%, 88%
66.4%, 86%
78.2%, 85.2%
M/N=0.25
M/N=0.375
M/N=0.5
M/N=0.625
M/N=0.75
M/N=0.875
M/N=1
Random Allocation and De-allocation
Sequential Allocation

Fig. 20